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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/093,291	06/08/98	VAN BUSKIRK	P ATMI-272

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STEVEN J HULTQUIST
INTELLECTUAL PROPERTY TECHNOLOGY LAW
P O BOX 14329
RESEARCH TRIANGLE PARK NC 27709

EXAMINER	
OLSEN, A	
ART UNIT	**PAPER NUMBER**
1746	3

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/093,291	Applicant(s) Van Buskirk et al.
	Examiner Allan Olsen	Group Art Unit 1746

☒ Responsive to communication(s) filed on *Jun 8, 1998* .

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-50* is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-18, 23, 24, and 28-50* is/are rejected.

☒ Claim(s) *19-22 and 25-27* is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☒ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____ .

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____ .

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *2*

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Information Disclosure Statement

1. The IDS submitted 9/10/98 refers to the related application 08/975,366. This file has been allowed and is currently unavailable to the examiner therefore, this document has not yet been considered. When the application file 08/975,366 becomes available it will be considered and with the next Office Action an initialed copy of the IDS will be sent to verify the consideration of this document.

2. Document AM cited on the IDS, the report authored by G. Stauf, was considered but was not used as prior art to reject the claims of this application because the report is not a public document.

Specification

3. The disclosure is objected to because of the following informalities:

- page 10, last two lines of next to last paragraph - the phrase "...another compound, such as silicon..." is incorrect as silicon is not a compound.
- page 11, bottom third - should the formula "$(CO)_yIr(X)_{1-6}$" be -- $(CO)_yIr(X)_{6-y}$ -- ?
- page 13-14, bridging sentence is confusing.

Appropriate correction is required.

Claim Objections

4. The numbering of claims is not accordance with 37 CFR 1.126. Number 48 was skipped in the original presentation of claims. Therefore, the claims originally presented as claims 49, 50 and 51 have been renumbered as claims 48, 49 and 50.

5. Claims 21, 23, 25, 27, 29-33, 43, 44 are objected to because of the following informalities:

➢ claims 21 and 25 - Lewis-base adducts are listed as possible cleaning enhancement agents. In claim 20 these agents are said to assist in volatilizing and removing the noble metal residue. Lewis bases are well suited to fulfill this role as they may bond or form adducts with the metallic residue. For a Lewis base to function in this capacity it must be available to form an adduct and not be tied up in the form of an adduct as claims 21 and 25 recite. A Lewis base bound in an adduct can not function as a cleaning enhancement agent in the manner required by claim 20.;

➢ Similar concerns regarding claims 23, 27, 30, 32 arise as a result of classifying products of the cleaning reaction as cleaning enhancement agents;

➢ in claims 29-33 the phrase "...is present in the contacting..." and a similar phrase in claim 43 is incorrect. A particular species may be present in the gaseous mixture during the contacting;

➢ claim 44 is missing word(s) - "...retaining the cleaning in the chamber...";

➢ Claim 50 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 50 limits the selection of the gas phase reactive halide composition to radicals of SiF_2 and SiF_3 whereas claim 47, which claim 50 is dependent upon, limits the gas phase reactive halide composition as being selected from the group consisting of SF_6, SiF_4 and Si_2F_6.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 7, 23, 24, 43, 47 and 49 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. Claim 7 recites the limitation "for each fill of the cleaning gas". There is insufficient antecedent basis for this limitation in the claim.

9. Claim 23 recites the limitation "the cleaning enhancement agent comprises an iridium halide species". There is insufficient antecedent basis for this limitation in the claim.

10. Claim 24 recites "...wherein the cleaning gas comprises a gas phase reactive halides species selected from the group consisting of SF_6, SiF_4, Si_2F_6 and SiF_2 and SiF_3 radicals..." It is not clear if the SiF_2 and SiF_3 radicals are members of the reactive halide group and as such are optional components of the cleaning gas or if they are required elements of the cleaning gas. Does the cleaning gas comprises a reactive halide species and radicals of SiF_2 and SiF_3 or does it comprise a reactive halide species that could be SiF_2 and SiF_3 radicals?

11. In claim 43 the phrase "...wherein elemental silicon is present with the gas-phase XeF_2 in said contacting..." possibly suggests that the elemental silicon is in the gas phase for which there is no support in the specification. The examiner believes the claim to mean that there is solid elemental silicon within the reaction chamber during the said contacting.

12. Claim 47 recites the limitation "the cleaning gas". There is insufficient antecedent basis for this limitation in the claim.

13. Claim 49 recites the limitation "the gas phase reactive halide composition". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

15. Claims 1, 3-6, 8, 9, 13-18, 28-33 are rejected under 35 U.S.C. 102(e) as being anticipated by US 5,814,238 (Ashby et al., hereafter, Ashby).

☞ Claims 1, 15-18: Ashby teaches a method that uses a gas phase reactive halide composition for removing contaminants of Pt, Pd, Ir and Rh from a wafer's surface (col. 1, lines 10-16; col. 4, lines 4,5).

☞ Claim 3: As a reactive halide Ashby teaches the use of SF_6 (col. 4, line 62).

☞ Claims 4, 13, 14, 30-32: SiF_x species, including radicals, are inherently present in the method of Ashby, as are the hexafluorides of the noble metal. Ashby teaches the removal of metal/metal silicides in a fluorine plasma environment which would inherently produce these claimed species (col. 7, line 45-67).

☞ Claim 5: Ashby teaches operating at a temperature of up to about 200°C (col. 7, line 18).

☞ Claim 6: While Ashby does not teach a process in which the pulling of a dynamic vacuum on the chamber is ceased by, for example, the closing of a valve, Ashby does teach a method that reads on claims 6 in the sense that during the time that the reactive halide is contained ("retained") in the chamber it reacts with and thereby removes the noble metal residue.

☞ Claims 8, 9: Ashby teaches a flow rate of 11 sccm and pressure of 125 mTorr (col. 8, lines 3,4).

☞ Claim 28, 29, 33: Ashby teaches the use of a cleaning enhancement agent/Lewis base (e.g. PF_3, CO, PR_3), an inert gas and a plasma (abstract; col. 3, line 26 - col. 5, line 8).

16. Claims 1-4, 6, 8, 12-15, 28, 30, 31, 33, 41, 43, 44, 46-50 are rejected under 35 U.S.C. 102(e) as being anticipated by US 5,911,887 (Smith et al., hereafter, Smith).

☞ Claims 1, 15: Smith teaches a method that uses a gas phase reactive halide composition for removing Pt from a wafer's surface (col. 1, lines 58-65).

☞ Claims 2, 41: As a reactive halide Smith teaches the use of XeF_2 (col. 5, line 60).

☞ Claim 3: As a reactive halide Smith teaches the use of SF_6 (col. 5, line 60).

☞ Claims 4, 12-14, 30-32, 43, 46, 49 and 50: PtF_6 and SiF_x species, including radicals, are inherently present in the method of Smith. Smith teaches the removal of Pt when silicon is present on the wafer. Reactions of both Si and Pt between fluorine atoms generated form XeF_2, or between species of a fluorine plasma environment, would lead to the claimed species (col. 3, 13-18; col. 5, lines 38-47).

☞ Claims 6, 44: While Smith does not teach a process in which the pulling of a dynamic vacuum on the chamber is ceased by, for example, the closing of a valve, Smith does teach a method that reads on claims 6 in the sense that during the time that the reactive halide is contained ("retained") in the chamber it reacts with and thereby removes the noble metal.

☞ Claims 28, 33: Smith teaches the use of a cleaning enhancement agent/Lewis base (e.g. PF_3, CO), an inert gas and a plasma (col. 5, lines 5, 58-60).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. Claims 1, 7 and 34-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ashby ('238).

Ashby teaches a method of removing contamination from semiconductor wafers as described above. The method is very generic with regard to particular ways the method may be used. The reference broadly refers to electronic circuits, which generically embraces a capacitor

One skilled in the art would have been motivated to use Ashby's method to remove the impurities of the type described in claims 34-40 because, as pointed out by the applicant in pages 2-4 of the specification, it is well known that such impurities are present at the claimed stage of processing, and in the claimed form. Furthermore, it is well known and admitted that such impurities are very disadvantageous. Therefore, by applying Ashby's method for removing transition metal impurities from a wafer, one would eliminate or reduce problems, such as short circuiting, that are caused by such impurities.

The limitation of claim 7 pertains to the duration of the etching process. Process parameters such as time, flow rates, pressure, power or temperature are considered to be cause effective variables, the exact values of which may be optimized through routine experimentation, and as such are not patentable.

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
>
> *In re Aller* 105 USPQ 233, 255 (CCPA 1955).See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

19. Claims 7, 9-11, 42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith ('887).

Claims 7, 9, 42 and 45 pertain process parameters that are considered to be cause effective variables, the exact values of which may be optimized through routine experimentation. Should the applicant contend that the claimed values are critical in obtaining a new and unexpected result,

the applicant has the burden of proving such criticality. *In re Swenson et al., 30 C.C.P.A. (Patents) 809, 132 F.2d 1020, 56 USPQ 372 ; In re Scherl, 33 C.C.P.A. (Patents) 1193, 156 F.2d 72, 70 USPQ 204.*

Claims 10 and 11 pertain obtaining the XeF_2 vapor from sublimation of XeF_2.

Smith does not teach the nature of the XeF_2 source .

One skilled in the art would be motivated to obtain XeF_2 vapor through the sublimation of the solid because XeF_2 is a solid that very readily sublimes, therefore, this would be the most convenient and economical manner of obtaining the vapor.

Allowable Subject Matter

20. Claims 19-22, 25-27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

21. The following is a statement of reasons for the indication of allowable subject matter: The use of XeF_2 as a component of an etchant to etch Iridium is a novel feature. While this compound has previously been used to etch metals (such as Smith's etching of Pt) the examiner found no suggestions in the prior art to use XeF_2 for the etching of Ir.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 4,659426 (Fuller et al.) could be applied in almost exactly the same manner as Ashby, however, the examiner finds no need to do so at this time. For particularly relevant passages in Fuller see: abstract; col. 1, lines 1-12, 52-57; col. 2, lines 13-16 and 47-55; col. 5, lines 40-43; claims 22 and 23.

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is (703) 306-9075. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached on (703) 308-4333. The fax phone number for this Group is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen
September 29, 1999

RANDY GULAKOWSKI
PRIMARY EXAMINER